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IG048: GUIDELINE ON ADMINISTRATION OF SUBSTANCES TO LABORATORY ANIMALS

This guideline provides general information for the administration of substances to laboratory animals. The routes of administration, intervals between administration, dose, and volume to be administered should be listed in an approved animal use protocol. All procedures must be approved by the Institutional Animal Care & Use Committee (IACUC).

These guidelines apply to healthy, adult animals. If using immature, aged, debilitated, or otherwise compromised animals, Campus Animal Resources veterinary staff (CARVETS@msu.edu) should be consulted regarding the best options for substance administration.

Personnel performing substance administration should be familiar with relevant anatomy of the species and proficient in the administration technique. Training is available by contacting Campus Animal Resources CARTRAIN@msu.edu.

DEFINITIONS

Enteral: Administration of substances into the gastrointestinal tract. Routes of enteral administration include:

- **Oral (Per os [PO]):** Administration of substances by mouth.
- **Gavage:** Administration of substances via a tube that is passed through the nose or mouth into the esophagus or stomach.

Parenteral: Administration of substances outside of the gastrointestinal tract. Routes of parenteral administration include:

- **Subcutaneous (SC):** Administration of substances into the space under the skin.
- **Intradermal (ID):** Administration of substances into the dermis.
- **Intramuscular (IM):** Administration of substances into the muscle.
- **Intranasal (IN):** Administration of substances into the nose.
- **Intraperitoneal (IP):** Administration of substances into the abdominal cavity.
- **Intravenous (IV):** Administration of substances into venous circulation.

Bolus: Administration of a volume of substance given all at once.

Infusion: Administration of a volume of substance given over a period of time.

ADMINISTRATION OF SUBSTANCES*

Substances administered parenterally should be:

- Close to physiologic pH (6.8-7.2). If pH is outside of physiologic range, administer the substance through a central vessel (e.g., jugular or femoral vein) or buffer the solution to reach an appropriate pH.
- Isotonic; the same concentration of solute as the blood.
- Sterile, endotoxin free, and delivered aseptically. If not commercially manufactured, the solution should be prepared aseptically and filtered through a 0.2 micron filter. Refer to **IACUC Guideline IG005** for additional expectations for using non-pharmaceutical grade substances.
- Substances should be administered at an appropriate volume as determined by route, species, and animal size (Table 1).

- For most mammalian species, the following volumes can be safely administered:
    - 5 ml/kg subcutaneously
    - 0.05 ml/kg intramuscularly
    - 10 ml/kg intraperitoneally
    - 5 ml/kg intravenously as a *bolus*
    - 2 ml/kg/hr intravenously by *infusion*
- Excessive volumes by any route may cause pain, tissue injury, changes in substance absorption, and leakage from the injection site

*Any exemptions to this guideline may be considered by the IACUC if ***scientifically justified***.

Table 1: Drug Administration Routes and Volumes (Maximal Dose Volume)

Species	PO (ml/kg)	Gavage (ml/kg)	SC[A] (ml/kg)	ID (ml/site)	IM[B] (ml/kg/inj)	IN (ml/inj)	IP (ml/kg)	IV *bolus* (ml/kg)	IV *infusion* (ml/kg/hr)
Mouse	5 (10)	1-5 (20)	1-5 (40)	0.05-0.1	0.05 (0.1)[C]	0.03-0.05	1-10 (20)	1-5	2 (4)
Rat	5 (10)	1-5 (20)	1-5 (10)	0.05-0.1	0.05 (0.2)	0.03-0.05	1-10	1-5	2 (4)
Rabbit	5	1-5 (20)	1-2.5	0.05-0.1	0.05	0.2-0.5	1-5	1-5	2 (4)
Cat	5 (20)	1-5 (20)	1-5	0.05-0.1	0.05	0.2-0.5	1-10	1-5	2 (4)
Dog	5 (20)	1-5 (20)	1-5	0.05-0.1	0.05 (0.1)	0.2-0.5	1-10	1-5	2 (4)
Minipig	5 (20)	1-5 (20)	1-5	0.05-0.1	0.05 (0.1)	0.2-0.5	1-10	1-5	2 (4)
Sheep & Cattle	5 (20)	1-5 (20)	1-5	0.05-0.1	0.05 (0.1)	0.2-0.5	1-10	1-5	2 (4)

[A] Subcutaneous sites should be limited to two or three sites per day.

[B] Reflects volumes for adult animals in large muscle bodies (triceps, quadriceps, dorsal lumbar, semimembranosus, semitendinosus). Large volume IM injections will need to be injected in multiple sites. For large animals, a general guideline is no more than 5 mL per site for animals >10 kg body weight. No more than 2 intramuscular sites should be used per day.

[C]For mice, a maximum of 50 µL per IM injection site is recommended; volumes >50 µL display variable distribution into extramuscular tissues.

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